COMPARISION OF THE EFFECTIVENESS OF BRACING [COUNT'R – FORCE FOREARM BRACE] VS. TAPPING [MACDONALD] IN PATIENTS WITH LATERAL EPICONDYLITIS

A Dissertation Submitted to

THE TAMILNADU Dr. M.G.R. MEDICAL UNIVERSITY

CHENNAI

in partial fulfillment of the requirements

for the award of the

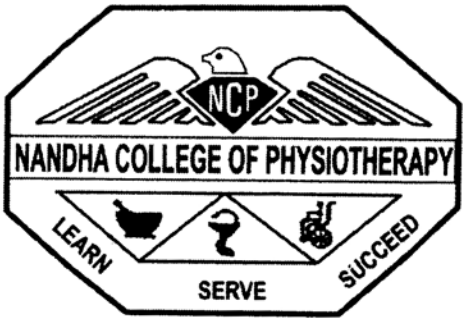
MASTER OF PHYSIOTHERAPY

(ADVANCED PHYSIOTHERAPY IN ORTHOPAEDICS)

DEGREE

Submitted by

Reg. No.27102001



NANDHA COLLEGE OF PHYSIOTHERAPY

ERODE – 638 052.

APRIL 2012

THE TAMILNADU DR.M.G.R MEDICAL UNIVERSITY

NANDHA COLLEGE OF PHYSIOTHERAPY

ERODE-638052

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A Dissertation submitted to

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CHENNAI

Dissertation evaluated on ----------

Internal Examiner External Examiner

CERTIFICATE BY THE HEAD OF THE INSTITUTION

This is certify that the dissertation entitled "**COMPARISION OF THE EFFECTIVENESS OF BRACING [COUNT'R – FORCE FOREARM BRACE] VS. TAPPING [MACDONALD] IN PATIENTS WITH LATERAL EPICONDYLITIS "** is a bonafide compiled work, carried out by **Register No. 27102001**, Nandha College of Physiotherapy Erode – 638 052, in partial fulfillment for the award of Degree in Master of Physiotherapy as per the doctrines of requirements for the degree of the TAMILNADU DR.M.G.R. MEDICAL UNIVERSITY CHENNAI – 32. This work was guided and supervised by **Prof.V.MANIVANNAN M.P.T (ORTHO)**

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This is to certify that the dissertation entitled "**COMPARISION OF THE EFFECTIVENESS OF BRACING [COUNT'R – FORCE FOREARM BRACE] VS. TAPPING [MACDONALD] IN PATIENTS WITH LATERAL EPICONDYLITIS "** submitted by **Reg No. 27102001** is a record of original and independent work done by the candidate during the period of study under my supervision and guidance. The dissertation represents entirely an independent work on the part of the candidate but for the general guidance by me.

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ACKNOWLEDGEMENT

"AT THE VERY OUSET, I THANK THE ALMIGHTY FOR HIS BLESSINGS TO ENABLE ME TO COMPLETE THIS PROJECT AND I OFFER THIS PROJECT AT HIS FEET AS MY HUMBLE PRAYER"

I am grateful to our principal **Prof.V.MANIVANNAN, M.P.T., M.I.A.P.,** for granting me permission to do this dissertation in our institution.

I extend my sense of gratitude to my guide **Prof.V.MANIVANNAN M.P.T., M.I.A.P.,** Nandha College of Physiotherapy for his valuable suggestion, exquisite guidance and constant encouragement throughout the duration of my dissertation.

I am also thankful to my friends and colleagues for their cooperation and suggestions even in between their busy schedule.

Last but not least I thank all the subjects participated in this study for their cooperation and patience shown towards me. Without their cooperation this study would not be completed.

This project is dedicated to my parents

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INTRODUCTION

Lateral epicondylitis, is a common condition that is characterized by pain at the lateral epicondyle, aggravated by resisted dorsiflexion of the wrist. Lateral epicondylitis was defined by Runge et al for the first time in 1873.

It's otherwise known as lateral epicontylagia or tennis elbow, shooter's elbow or arches elbow.

Epidemiology

The estimated annual incidence in the general population is 1% to 3%. Lateral epicondylitis has an incidence of 4 new cases per thousand annually, although playing of the tennis causes only 5-10% of all cases, 40-50% of tennis players experience this condition at some time of their life. The prevalence range is from 1-3% in general population, and peak incidence is at 40-50 years of age.

Biomechanics

Biomechanically, the wrist muscles are essential in preventing the active and passive insufficiencies that can occur with contraction of the extrinsic muscles of fingers (long finger flexors and extensors). As fingers actively close in to make a fist, the wrist automatically extends. Similarly the wrist flexes as the fingers actively extend. The wrist extensor muscles contract with the finger flexor muscles to counteract the flexion moment at the wrist exerted by the finger flexors. Wrist extension occurs during finger flexion, thereby maintaining adequate length of the finger flexors, allowing closure of the fingers. At the same time wrist extension puts the finger extensor tendon on enough slack to allow the necessary finger flexion excursion. The presence of pain at the lateral epicondyle in a person with lateral epicondylitis when shaking hands demonstrates the role of the wrist extensors during activities using the finger flexors[3]. The most active wrist extensor muscle during gentle fist is the extensor carpi radialis brevis. As the grip force increases, the extensor carpi ulnaris and extensor carpi radialis longus join the activated extensor carpi radialis brevis[4].

Etiology

While it is commonly stated that lateral epicondylitis is caused by repetitive overuse and micro trauma, this is a speculative etiological theory with limited scientific support that is likely overstated. The risk factors for lateral epicondylitis include taking up tennis later in life, unaccustomed strenuous activity, decreased reaction times, increased speed and repetitive eccentric muscle contractions.

Pathophysiology

Lateral epicondylitis has been proposed to involve a tear of the tendon of origin of the extensor muscles from lateral epicondyle. The tear occurs at the junction between muscle and bone, and healing is slow because of a lack of periosteal tissue overlying this bone area. It has been shown that the granulofibroblastic material laid down in the repair process contains free nerve endings. Repetitive micro trauma from overuse or abnormal joint biomechanics may overload the repairing tissue, mechanically distort the scar tissue and thus stimulate the free nerve endings sufficiently to evoke mechanical nociceptive pain. The blood supply to the muscle origin is limited and it is suspected that it would be further prone to reduced blood flow after injury. Also the patient's age is a significant factor in reduced vascularity of the musculotendinous insertion.

This might occur from some increase in use of the tendon, for example, with carpentry, gardening or playing tennis.It may also occur with normal activity levels if the tendon's capacity to attenuate tensile load is reduced.

In the case of tennis players, repetitive backhand strokes mainly in unskilled players with single handed backhand produces recurrent micro traumatic injury to the wrist extensors at their lateral epicondylar origin.

The susceptibility of extensor carpi radialis brevis muscle to excessive strain is probably related to the added tensile load imposed on the tendon by the radial head when the tendon is stretched (e.g., wrist flexion, elbow extension and forearm pronation). In this position the tendon is further stretched over the prominence of the radial head. This is further compounded by the head of the radius rotating anteriorly against extensor carpi radialis brevis during pronation of the forearm. Additionally, a number of individuals may experience pain at the head of the radius during pronation, due to irritation of an underlying bursa. If the patient with lateral epicondylitis continues to perform activities that stress the tendon, the immature collagen produced in an attempt at repair continues to break down before it has chance to mature adequately, and the chronic inflammatory process continues. But, if the part is completely immobilized, there may not be adequate stress to the new collagen to stimulate maturation, in which case the scar will again break down on resumption of activities.

Lateral epicondylitis has a well defined clinical presentation, the main complaints being pain and decreased grip strength, both of which may affect activities of daily living. Onset of pain is gradual, may be related to activities such as grasping, hitting a backhand stroke in tennis or pruning shrubs. The patient may rarely recall a sudden onset of pain during these activities; pain varies from dull ache or no pain at rest to sharp twinges or a straining sensation with activities. Active movements of wrist are usually painless. In more severe cases there may be some pain with active wrist flexion with the elbow in extension from the stretch placed on the tendon. Full passive wrist flexion with ulnar deviation, forearm pronation, and elbow extension produces pain (Mills test). Resisted wrist extension (Cozen’s test) with the elbow extended reproduces pain in the lateral epicondyle. On palpation, tenderness may often extend down into the muscle belly; warmth may be noted at the lateral epicondyle.

OPERATIONAL DEFINITION:

Tennis elbow:

Tennis Elbow is inflammation, soreness or pain on the outside (lateral) side of the upper arm near the elbow. There may be a partial tear of the tendon fibers, which connect muscles to bone. That a may be at or near where these fibers begins, on the outside of the elbow.

Lateral Epicondylitis or Lateral epicondylagia also known as tennis Elbow shooter's or archer's elbow.

Count'R force forearm brace:

The count'R force forearm brace offers equal compression around the entire forearm to ensure support and stress relief of forearm muscles. Highly effective for treating or preventing tennis elbow.

Brace is extra wide and curved to control injured or weak muscles comfortably while offering balance compression during activities.

Tapping :

Adhessive tape with the mechanical strength to resist streatching. It's applied to the skin to support stabilize and restrict movement to aid healing and or prevent musculo skeletal injuries.

Ultra sound therapy:

Ultra sound is high frequency sound ways, greater then 20,000 HZ therapeutic ultra sound is in the frequency range of 0.9 – 3 MHZ.

Ultra sound therapy widely used in the sports field. Ultra sonic waves when projected as a beam from a transducer penetrate and strike the tissues and the energy is converted into heat which is used for relief of pain and inflammation

AIM OF THE STUDY

To compare the effectiveness of Counter force forearm bracing & MacDonald taping in the management of patients with lateral epicondylitis.

NEED OF THE STUDY

Bracing and taping were either used as adjunctive treatment with electrotherapeutic modalities in the management of patients with lateral epicondylitis by the Physiotherapists. Thus the need of the study is to find whether bracing or taping is the best adjunctive treatment for the patients with lateral epicondylitis.

HYPOTHESES

NULL HYPOTHESES:

There is no significant difference between the effectiveness of Counter-force Forearm Bracing & MacDonald Taping in the management of patients with lateral epicondylitis.

ALTERNATE HYPOTHESES:

There is a significant difference between effectiveness of Counter-force Forearm Bracing & MacDonald Taping in the management of patients with lateral epicondylitis.

REVIEW OF LITERATURE

Hillman et al (2005) in their study on various postures for hand grip measurement suggested that measurement of grip strength using hand dynamometry is reproducible and consistent. As all patients are not able to sit in a chair with elbows unsupported, in clinical practice it is more practicable to perform hand dynamometry with the elbows supported in a bed or armchair. Elbow braces are prescribed on the assumption that it diffuses the load to less sensitive areas of forearm, constrains full extensor muscle expansion thereby reducing pain and improving grip strength in patients with lateral epicondylitis[2].

Struijs et al (2005) in their study concluded that the extensor grip test seems valuable as a predictive factor for the effectiveness of bracing as treatment for tennis elbow over the short term period. Tape has been in use to support joints and prevent injuries in athletics since the beginning of the nineteenth century. Tape should reinforce the normal supportive structures in their relaxed position and protect injured tissues from further damage[1].

G.Y.F.Ng et al (2004) tested dominant arm of 15 lateral epicondylitis patients under 4 randomized conditions: 1. no brace, 2. brace without tension, 3. brace with 25 N tension and 4. Brace with 50 N tension. The tests included isokinetic wrist extensors strength, passive stretching force in wrist flexion to elicit pain in the wrist extensors, wrist proprioception and stretch reflex latency of the extensor carpi ulnaris. Among the four conditions, significant differences were found in wrist proprioception ($p=0.032$) and pain threshold to passive stretching of the wrist extensors ($p=0.5$), but were not found in wrist extension isokinetic strength and stretch reflex latency of the extensor carpi ulnaris.

Struijs et al (2004) randomized 180 patients over 3 groups: brace-only treatment, physical therapy, and the combination of these. Outcome measures were success rate, severity of complaints, pain, disability, and satisfaction. Follow-up was done after one year. Physical

therapy was superior to brace only at 6 weeks for pain, disability, and satisfaction. Contrarily, brace-only treatment was superior on ability of daily activities. Combination treatment was superior to brace on severity of complaints, disability, and satisfaction. At 26 weeks and 52 weeks, no significant differences were identified. They concluded that brace treatment might be useful as initial therapy. Combination therapy has no additional advantage compared to physical therapy but is superior to brace only for the short term period.

Nicholas J. Meyer et al (2003) did a study on 21 subjects without any symptoms of lateral epicondylitis to support band pressure during gripping activity giving a specific starting pressure. The subjects had one of the two modified forearm bands applied. One forearm band consisted of an air pillow forearm support band modified to hold a pediatric blood pressure cuff in its pocket and the other was same band without pillow in the pocket with the pediatric BP cuff laid flat over the extensor wad. Cuff was inflated to starting pressure of 20, 40, 60 or 80 mmHg to simulate forearm support band application pressure. The maximum pressure generated was measured from the sphygmomanometer cuff and the maximum grip was also recorded. Results revealed an increased forearm support band effect with increased band pressure and a decreased relative effect with increased force applied distally. Forearm support band may be most effective when applied at 30 to 50 mmHg at rest, resulting in up to 120 mmHg pressure during activity. This would result in a force reduction at the extensor carpi radialis brevis origin of approximately 13 to 15% throughout the range of activity levels.

Vicenzino et al (2003) did a study of elbow taping technique on 16 subjects with chronic lateral epicondylitis. There were three levels of the treatment condition- diamond tape, placebo tape and a no tape control Outcome measures were pain-free grip strength and pressure pain threshold taken before, immediately after, and 30 minutes after application of tape. The results were, the taping technique significantly improved pain free grip strength by 24% from baseline ($p=0.028$). The treatment effect was greater than that for the placebo and control conditions. Changes in pressure pain threshold (19%), although positive, were not statistically significant[12].

Gabriel et al and Andy Fan et al (2001) in their study on the effect of elbow positioning on grip strength and it's between day reliability with Jamar dynamometer, found that grip strength at 90 degrees of elbow flexion was highest among all positions and that between-day comparison of grip strength is valid and reproducible in the testing position[16].

Knebel et al (1999) in their study assessed peak wrist extension isometric force, peak isometric grip force, and median power spectral frequency for wrist extensor electro myography activity with and without a forearm support band before and after a fatiguing bout of activity. Their results showed that wearing the forearm support band increased the rate of fatigue in unimpaired individuals[18].

De Smet et al, Fabry et al (1997) in a study on 20 patients with chronic lateral epicondylitis found that grip strength with the elbow in extended position was significantly reduced when compared with elbow at 90 degrees flexion ($p<0.0001$). While on the normal side, the grip strength measured with the elbow in extension was not significantly different when compared to the grip strength measured with the elbow in 90 degrees of flexion[20].

Clements and Chow et al (1993) in their study on 16 patients with lateral epicondylitis found that subjects wearing splint (non articular in-elastic splint) and receiving physiotherapy had greater improvement in pain and grip strength in affected extremity than the subjects receiving therapy alone.

Wadsworth et al. (1989) proposed that the effects of the arm band in patients who have pathology may differ from those in patients without pathology. In those without pathology, the armband may decrease strength by mechanically limiting maximal contraction. In those with pathology, it may increase strength by lessening pain and thus permitting a more forceful contraction[24].

Groppel et al (1986) used three commonly used counterforce braces and compared it with unbraced condition. They showed that electromyography activity of extensor carpi radialis

is reduced in braced forearms during tennis strokes and biomechanical alteration in forearm muscle activity and angular joint acceleration is dependent upon the brace and joint area analyzed. A comparison of Integrated Electromyography (IEMG)[25] activity of extensor digitorum communis (EDC) and extensor carpi radialis brevis (ECRB) on normal subjects with standard and Air cast tennis elbow band revealed that the aircast caused a significant reduction in Integated EMG of the ECRB and EDC when compared with control values and the standard band[26].

Burton et al (1985) measured the grip strength of 27 patients with lateral epicondylitis had their grip strength measured without a strap, with an elastic strap and with an inelastic strap. Of these, 85% of the subjects displayed an increase in pain free grip strength with one or both straps. The increase in pain free grip strength was statistically significant for both types of strap ($p<0.001$)[28].

Morris et al (1982) recommended splints for the treatment of lateral epicondylitis. He suggested the use of either elastic armlet or an India-rubber bandage about the elbow producing restriction in the movements of pronation and supination as an effective treatment for lateral epicondylitis.

American society of hand therapists (1981) recommended that the standard position for hand grip strength measurement is the subject sitting in a chair with armrest with the shoulder at 0 degrees of abduction and neutral rotation, elbow at 90 degrees of flexion, forearm in midprone position and wrist at neutral flexion/extension rested over the armrest of the chair[16].

METHODOLOGY

Study design	**:** Quasi Experimental design
Sample size	**:** 30 subjects
Sampling method	**:** Convenient sampling
Study duration	**:** 3 Months
Study Settings	: LKM Hospital – Erode
	: Erode ortho Hospital – Erode
	: Nandha College of physiotherapy – out patient department.

INCLUSION CRITERIA

- Age**:** 20-45 years.
- Gender: Both male and female .
- Pain measured by Oxford Elbow Scale >= 3 and tenderness of Grade>=2 in lateral epicondyle. About 5 mm anterior and distal to lateral epicondyle.
- An increase of pain during resisted dorsiflexion of the wrist and grasping.
- Duration of the condition was 1 - 6 weeks [Acute].
- Special Tests namely Mills test & Cozen's test should be positive for diagnosis of lateral epicondylitis.
- Unilateral involvement.

EXCLUSION CRITERIA

- Chronic case of lateral epicondylitis.
- Previous history of Fractures and dislocation of the involved upper limb.
- C_6 radiculopathy.
- Ligament injuries of elbow and wrist.
- Allergies to adhesive tape.
- Synovial fringe impingement.
- Radial tunnel syndrome.
- Patients who were not cooperative.

MATERIALS REQUIRED

- Modified sphygmomanometer
- Non elastic adhesive tape
- Counter-force Forearm Brace
- Scissors
- Ultra sound therapy machine
- Oxford Elbow Score

- 

The Materials used in this Study

Modified Sphygmomanometer

- The cuff of the sphygmomanometer was rolled into concentric layers and adhesive tape was then applied over the roll.
- Then the cuff was connected to the sphygmomanometer and inflated to 20 mmHg, so that it formed into a modified sphygmomanometer to measure hand grip strength.

Adhesive Tape

- It was a Hypoallergenic adhesive tape
- Breadth of 38-mm strapping tape,

Counter-Force Tennis Elbow Brace

The Counter-Force Tennis Elbow Brace is approximately 8cm wide at the center and 7.5cm near the ends constructed of a soft elastic fabric with a Velcro strap. Velcro strap is of 5cm width and 40cm length.

PROCEDURE

30 Subjects were included in the study after they met the inclusion and exclusion criteria. Informed consent was obtained from each subject. Then the subjects were randomly allocated into two groups (Group A and Group B) of 15 members each.

Group A subjects were treated with Counter-force forearm bracing along with conventional therapy for 3 weeks.

Group B subjects were treated with MacDonald taping along with conventional therapy for 3 weeks.

Group A - Counter-Force Tennis Elbow Bracing

The Counter Force Forearm brace was applied below the elbow around two finger breadths below lateral epicondyle of the involved upper extremity. The subjects were instructed to apply the brace during the activities. They were told that they can remove the brace during sleeping.

The Subject in Group A wearing Counter Force Forearm Brace

Group B – MacDonald Taping

- **Position**: - Subject was made to sit with the elbow of the affected upper extremity flexed to 90° and the forearm fully supinated.
- **Application** :-
  - Tape Anchor was placed midway around the forearm of the affected upper extremity.
  - A strip of tape was attached to the anchor on the medial side of the forearm.
  - It was then directed obliquely up the arm slightly above the lateral epicondyle
  - The tape was continued around the lateral part of triceps & finished on the medial aspect of biceps.
  - A second strip of tape was applied
  - The first anchor was then reapplied.

The Subject in Group B been applied Macdonald Taping on the affected upper extremity

Conventional therapy

It consisted of ultrasound therapy and exercise program.

Ultrasound Therapy

Position of patient	-	sitting position and forearm rested on a pillow
Duration	-	10 minutes
Mode	-	pulsed(1:1 Ratio)
Frequency	-	1 MHZ
Application technique	-	direct contact over the lateral epicondylar region

Exercise Program

The exercise program was started after the reduction of pain. It mainly consisted of stretching and strengthening exercise to the wrist extensor muscle groups.

OUTCOME MEASURES

The following dependent variables were measured before the intervention and immediately after three weeks of intervention:-

- **Grip Strength** measured by the modified Sphygmomanometer.
- **Functional** outcome measured by Oxford Elbow Score.

Grip Strength

Grip Strength was measured by modified sphygmomanometry as proposed by Fan et al[16]. The individual subject was made to sit in the chair with arm and back rested as per American hand association guidelines. The forearm of the affected side of the subject was placed on the arm rest as such the elbow flexed to 90 degrees. The subject was been told to hold the cuff in his hand. The cuff of the sphygmomanometer was then inflated to 20 mmHg. Then the subject was instructed to squeeze the inflated cuff as far as possible. The difference between the last and initial reading was recorded. The measurement was repeated for three times with one minute rest between the trials. The average value of the three readings was taken as hand grip strength for the particular subject.

Functional Outcome

Functional outcome was measured by Oxford elbow score. It is a functional scale having 12 questions regarding the pain and difficulty in performing their daily functional activities. The minimum score for each question was “1” showing decreased function and maximum score was “5” showing maximum function. The total minimum score is “0” and the total maximum score is “48”. The measurement was done by questionnaire method.

Data Analysis and Interpretation

The collected data were recorded and tabulated. The data was analysed using statistical package for social science (SPSS) to present the finding of the study Efficiency counter-force forearm bracing & MacDonald taping in the management of patients with lateral epicondylitis identified through Visual Analog Scale Scores, Grip Strength & Functional Outcome.

Paired t-test

$$S.D = \frac{\sqrt{\sum(d - d')}}{n - 1}$$

$$S = SD/\sqrt{n}$$

$$t = \frac{d'}{S/\sqrt{n}}$$

$$d=x-y \qquad d'=\sum d$$

Where

d’ is the mean of change in values between pre and post treatment.

S.D is the standard deviation of pre and post treatment.

S is the standard error of the mean.

Data analysis was done with SPSS Software version 17.0. P value was set at less than 0.05 as significance for all analysis

TABLE 1

COMPARISON BETWEEN PRE & POST TEST GRIP STRENGTH OF GROUP A & GROUP B SUBJECTS

Parameter	Mean		t-test value	P-value
	Pre	Post		
Group A	97.467 MMHG	136.667 MMHG	12.250	0.000
Group B	115.20 MMHG	156.133 MMHG	13.803	0.000

In this table, $p<0.05$, there is a significant difference between Pre-test and Post-test Grip Strength in Group A and Group B subjects.

GRAPH 1

COMPARISON BETWEEN PRE & POST TEST GRIP STRENGTH OF GROUP A & GROUP B SUBJECTS

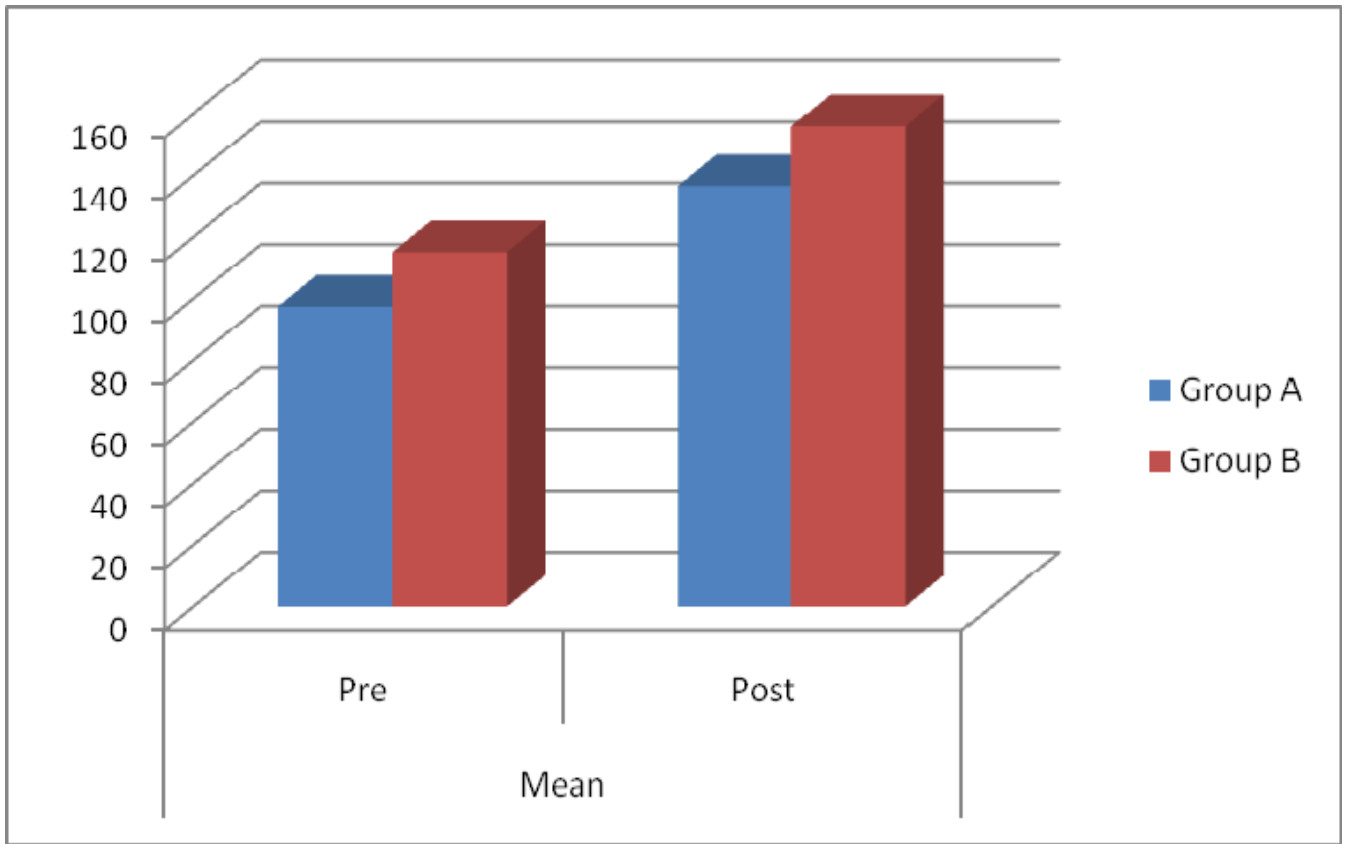


TABLE 2

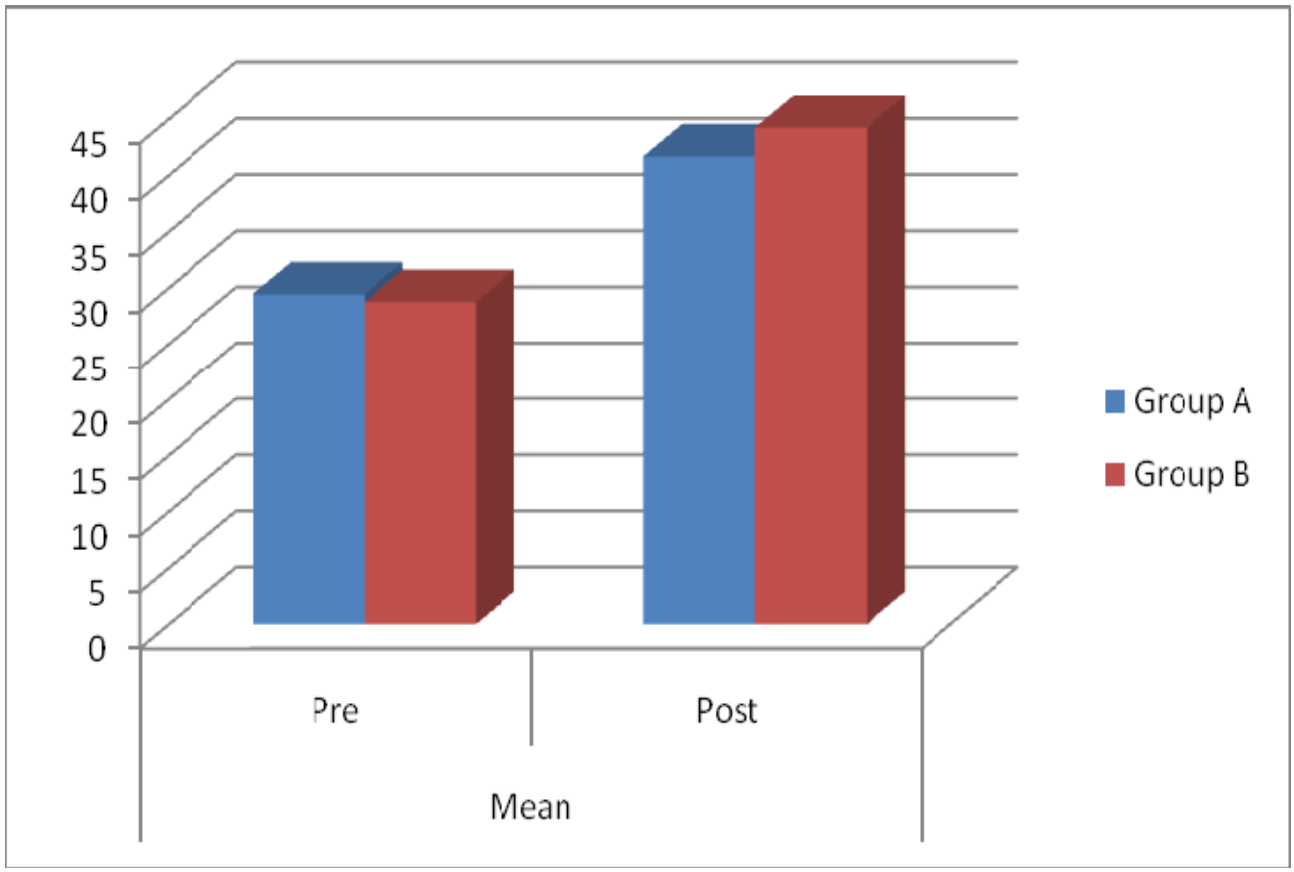
COMPARISON BETWEEN PRE & POST TEST FUNCTIONAL OUTCOME OF GROUP A & GROUP B SUBJECTS

Parameter	Mean		t-test value	P-value
	Pre	Post		
Group A	29.4	41.667	12.603	0.000
Group B	28.733	44.200	21.594	0.000

In this table, $p<0.05$, there is a significant difference between Pre-test and Post-test Functional Outcome in Group A and Group B subjects.

GRAPH 2

COMPARISON BETWEEN PRE & POST TEST FUNCTIONAL OUTCOME OF GROUP A & GROUP B SUBJECTS



RESULTS & DISCUSSION

RESULTS

- **According to table 1**, the mean Pretest Grip Strength and Post test Grip Strength for Group A subjects were 97.467 and 136.667. The Mean Pre test Grip strength and Post test Grip Strength for Group B subjects were 115.20 and 156.133. Comparison of Pre test Grip Strength and post test Grip Strength of Group A subjects by paired t test showed that there was a statistically significant difference with t value = 12.250 at $p>0.05$. Comparison of pretest Grip Strength and Post test Grip Strength of Group B subjects by paired t test showed that there was a statistically significant difference with t value= 13.803 at $p>0.05$.

- **According to table 2**, the mean Pretest Functional outcome and Post test Functional Outcome for Group A subjects were 29.4 and 41.667. The Mean Pre test Functional Outcome and Post test Functional Outcome for Group B subjects were 28.733 and 44.200. Comparison of Pre test Functional Outcome and Post test Functional Outcome of Group A subjects by paired t test showed that there was a statistically significant difference with t value = 12.603 at $p>0.05$. Comparison of pretest Functional outcome and Post test Outcome of Group B subjects by paired t test showed that there was a statistically significant difference with t value= 21.594 at $p>0.05$.

DISCUSSION

Pain, grip strength & functional outcome were taken as outcome measures in our study, to compare the effectiveness of counter-force forearm bracing & MacDonald taping in the management of patients with lateral epicondylitis.

In our study, it was observed that no significant difference in effectiveness of counter-force forearm braces & MacDonald tapping on the reduction of pain in the patients with lateral epicondylitis. This might be attributed to the fact both taping and bracing by their supporting function reduced the stress on the origin site of wrist extensor group, thereby reducing the nociceptive stimulation from the painful area as proposed by Jane Derebery et al[10].

However, in our study it was observed that there was some difference in effectiveness of counter-force forearm bracing & MacDonald tapping in improving the grip strength of patients with lateral epicondylitis. Tapping was found to be somewhat more effective than bracing in improving the grip strength. It should be taken in account that the measurement of grip strength was done with Counter force forearm bracing & McDonald taping applied to the subjects.

The reason for our finding might be attributed to the fact that even though both counter-force forearm bracing & Macdonald taping produced proprioceptive feedback and enhanced proprioceptive acuity; they differed in their effects on efficiency of muscle contraction. Counter-force forearm bracing artificially shifts the wrist extensor origin from lateral epicondyle to upper forearm, reducing the stress on wrist extensor muscle origin, also it would have changed the length-tension relationship of the muscle as proposed by Snyder et al[20]. Thus it would have reduced the efficiency of contraction of wrist extensor muscles. However it seems that MacDonald taping did not affect the length tension relationship of muscle.

It was inferred from our study that MacDonald taping group showed more significant improvement in functional outcome when compared with counterforce forearm bracing group. This might be attributed to the fact that to perform the various functional activities effectively needs not only reduction in pain, but also good grip strength. Thus taping by effectively reducing

the pain & improving the grip strength of patient with lateral epicondylitis, produced more significant improvement in functional outcome in patients with lateral epicondylitis when compared with bracing intervention as proposed by Bill Vincenzino et al[14].

CONCLUSION

Thus the results of this study concludes that tapping is found to be more effective than counter-force forearm bracing in improving the grip strength & functional outcome of patients with lateral epicondylitis.. However, there was no significant difference in reduction of pain between the two interventions in patients with lateral epicondylitis. These findings have implications in the management of patients with lateral epicondylitis.

LIMITATIONS

The study duration was short.

The sample size was very less.

RECOMDATIONS

Sample size can be increased.

The study can be done for longer duration.

REFERENCES & BIBLIGRAPHY

1. Mani L, Gerr F. Work-related upper extremity musculoskeltal disorders. Prim care clinic office Pract. 2000;27: pg 845-64.
2. Nirschl RP, Pettrone FA. Tennis elbow: The surgical treatment of lateral epicondylitis. J Bone Joint Surg , 1979;61:pg 832-839.
3. Carol A. Oatis:Kinesiology .2004:pg.307
4. Cynthia Norkins.Joint Structure and Function, 2nd edition, J P Brothers 1999:pg 271.
5. Mark A. Jones, Darren A. Rivett Clinical reasoning for manual therapist .Published 2004; pg 89
6. Bradly S. Goodman, Matthew D. Berke,L Matthew Schwartz. The biomechanics of tennis injuries. Phy med and rehab: state of the art reviews- Oct1997;11(3):pg 675-695.
7. Darlene Hertling: Management of common musculoskeletal disorders. 3rd edition:pg217-242.
8. Briggs CA,Elliot BG. Lateral epicondylitis:A review of structures associated with tennis elbow. Anat clin. 1985;7(3):pg149-53
9. D Stasinopoulos, M Johnson. Cyriax physiotherapy for tennis elbow/lateral epicondylitis. Br. J Sports Med 2004;38: pg675-677
10. V.Jane Derebery, Jenny N. Devenport, Geneva M. Giang, W. Tom Fogarty. The effects of splinting on outcomes for epicondylitis .Arch phys med rehab June 2005; 86(6): pg1081-1088
11. Carin D Borkholder,Valerie A. Hill, Elaine Ewing Fess. The efficacy of splinting for lateral epicondylitis :A systematic review, Journal of hand therapy April 2004;17:pg 181-199
12. Nicholas J Meyer, Frank Walter, Barb Haines, Derek Orton, roger A. Daley. Modeled evidence of force reduction of the ECRB origin with the forearm support band. The J of Hand Surgery. March 2003;28(2):pg279-287
13. Rose Macdonald:Taping techniques.1996 : Pg 8

14. Bill Vincenzino,Jane Broosksbank, Joanne Minto, Sonia Offord, Aatit Paungmali. Initial effects of elbow taping on pain free grip strength and pressure pain threshold. J Orthop Sports Phys Ther July 2003;33(7):pg400-407
15. Tuomo T. Pienimaki, Pertti T Siira, Heikki Vanharanta. Chronic medial and lateral epicondylitis: A comparison of pain, disability, and function. Arch Phys Med Rehab , March 2002;83:pg317-321
16. Ng G Y F, Fan A C C. Does elbow position affect strength and reproducibility of power grip measurements? Physiotherapy. 2001, 87(2):pg 68-72
17. Hillman TE, Nunes QM, Horby ST, Stanga Z, Neal KR, Rowland BJ. et al A practical posture for hand grip dynamometry in the clinical setting. Clin Nutr.2005 Apr;24(2):pg 224-8
18. Burton AK. Grip strength and forearm straps in tennis elbow. Br J Sports Med. 1985 Mar;19(1):pg 37-8
19. Groppel JL, Nirschl RP: A mechanical and electromyographical analysis of the effects of various joint counterforce braces on the tennis player. AM J Sports Med. 1986;14:pg 195-200
20. Snyder-Mackler L, Epler M. Effect of standard and aircast tennis elbow bands on integrated EMG of forearm extensor musculature proximal to the bands. Am J.Sports Med1989;17:pg 278-281
21. Clements L, Chow S. Effectiveness of a custom made below elbow lateral counterforce splint in the treatment of lateral epicondylitis .Can J occp ther 1993;60:pg137-44
22. De Smet L, Fabry G. Grip strength in patients with tennis elbow: Influence of elbow position. J Of Hand Ther. 1997 Jul-Sep; 10(3): pg 229-31.
23. Knebel PT, Avery DW, Gebhardt TL, Koppenhaver SL, Allison SC, Bryan JM. Effects of the forearm support band on wrist extensor muscle fatigue. JOSPT Nov 1999;29(11):pg677-85
24. Wadsworth C, Nielsen D, Burns L, Krull J, Thompson C. Effect of the counterforce arm band on wrist extension and grip strength and pain in subjects with tennis elbow. J Ortho Sports Phys Ther. 1989; 11(5):pg192-197.

25. Struijs PA, Kerkhoffs GM, Assendelft WJ, Van Dijk CN . Conservative treatment of lateral epicondylitis – brace vs. physical therapy or a combination of both- A randomized clinical trial .The Am J Sports Med ;2004;34:pg 462-469,
26. G.Y.F. Ng, H.L.Chan. The immediate effects of tension of counterforce forearm brace on neuromuscular performance of wrist extensor muscles in subjects with lateral humeral epicondylosis. J Orthop Sports Phys Ther.Feb 2004;34:pg72-78
27. Struijs PA, Kerkhoffs GM, Assendelft WJ, Van Dijk CN . The predictive value of the extensor grip strength for the effectiveness of bracing in tennis elbow. Am J Sports Med 2005 Sep 12 :pg279-87
28. Gary B. Wilkerson. Biomechanical and neuromuscular effects of ankle taping and bracing. J Athl Train 2002 Oct-Dec, 37(4):pg436-445.
29. Whittgham M, Palmer S, Macmillan F. Effects of taping on pain and function in patellofemoral pain syndrome: A randomized controlled trial. J Orthop Sports Phys Ther. Sep 2004;34(9):pg 504-510
30. Micheal J Callaghan, James Selfe, Pam J Bagley, Jacqueline A. Oldham. The effects of patellar taping on knee joint proprioception. J Athl Train 2002 Jan- March: 37(1):pg19-24

PROFORMA

Assessment Form for Lateral Epicondylitis

Name: - Age: - Sex:-

Occupation:-

Chief Complaints:-

Present History:-

Past History:-

Pain

Intensity

Onset

Severity

Nature and type

Location

Aggravating Factors

Relieving Factors

On Observation:-

On Inspection:-

On Palpation:-

On Examination:-

Active ROM

Resisted Isometrics

Muscle Power (MMT)

Special Tests:-

a) Mills Test
b) Cozen’s Test
c) Maudsley Test
d) Hand Shake test

Functional Abilities:-

Problem list

Goals

Treatment

APPENDIX - 1

NANDHA COLLEGE OF PHYSIOTHERAPHY

PERUNDURAI, ERODE – 52, TAMIL NADU.

From,

J. JOSHUA EZHIL SELVAN
MPT 2nd Year, (Advanced Physiotherapy In Orthopaedics,)
Nandha College of Physiotherapy
Erode – 52.
Tamil Nadu.

To,

Mr. / Mrs. _____

Dear Sir / Madam,

I "Joshua ezhil selvan" doing Master of Physiotherapy in Nandha college. As a part of my course, I am doing my dissertation on topic **"Comparision of the Effectiveness of Bracing [Count'R-force Forearm Brace] Vs. Taping [Macdonald] in Patients with Lateral Epicondylitis"** I invite you to participate in study. Your participation in this study will be appreciated. I assure you that there is no risk because of participation in this study. I also assure you that all my treatment and personal details will be kept confidential. Please feel free to ask if you have any doubts.

Thanking you,

Yours Sincerely

CONSENT FORM

Consent To Participate In This Reseearch Study

I Mr. / Mrs. _____ voluntarly participate in the research study, **"Comparision of the Effectiveness of Bracing [Count'R-force Forearm Brace] Vs. Taping [Macdonald] in Patients with Lateral Epicondylitis"**

The research has explained to me the treatment approach in brief, the risk of participation and has answered the questions related to the research to my satisfaction.

Signature of The Participant

Signature of The Witness

Signature of The Researcher

Date :-

Place : -

APPENDIX - 2

Oxford Elbow Score

Clinician's name (or ref) _____ **Patient's name (or ref)** _____

Please answer the following 12 multiple choice questions.

During the past 4 weeks.....

1. Have you had any difficulty lifting things in your home, such as putting out the rubbish, because of your elbow problem?	**7.Have you been troubled by pain from your elbow at night?**
☐ No difficulty	☐ No, not at all
☐ A little bit of difficulty	☐ 1 or 2 nights
☐ Moderate difficulty	☐ Some nights
☐ Extreme difficulty	☐ Most nights
☐ Impossible to do	☐ Every night

2. Have you had difficulty carrying bags of shopping because of your elbow problem?	**8. How often has your elbow pain interfered with your sleeping?**
☐ No difficulty	☐ No, not at all
☐ A little bit of difficulty	☐ Occasionally
☐ Moderate difficulty	☐ Some days
☐ Extreme difficulty	☐ Most days
☐ Impossible to do	☐ Every day

3. Have you had any difficulty washing yourself all over, because of our elbow problem?	**9. How much has your elbow problem interfered with your usual work or everyday activities?**
☐ No difficulty	☐ No, not at all
☐ A little bit of difficulty	☐ A little bit
☐ Moderate difficulty	☐ Moderately
☐ Extreme difficulty	☐ Greatly
☐ Impossible to do	☐ Totally

4. Have you had any difficulty dressing yourself, because of your elbow problem?	
☐	No difficulty
☐	A little bit of difficulty
☐	Moderate difficulty
☐	Extreme difficulty
☐	No, impossible

10. Has your elbow problem limited your ability to take part in leisure activities that you enjoy doing?	
☐	No, not at all
☐	Occasionally
☐	Some days
☐	Most days
☐	All of the time

5. Have you felt that your elbow problem is "controlling your life"?	
☐	No, not at all
☐	Occasionally
☐	Some days
☐	Most days
☐	Every day

11. How would you describe the worst pain you had from your elbow?	
☐	No Pain
☐	Mild pain
☐	Moderate pain
☐	Severe pain
☐	Unbearable

6. How much has your elbow problem been "on your mind"?	
☐	No, not at all
☐	A little of the time
☐	Some of the time
☐	Most of the time
☐	All of the time

12. How would you describe the pain you usually had from your elbow?	
☐	No pain
☐	Mild pain
☐	Moderate pain
☐	Severe pain
☐	Unbearable

The Oxford Elbow Score is: 60

Interpreting the Oxford Elbow Score

Score 0 to 19	May indicate severe elbow involvement. It is highly likely that you may well require some form of surgical intervention, contact your family physician for a consult with an Orthopaedic Surgeon.
Score 20 to 29	May indicate moderate to severe elbow involvement. See your family physician for an assessment and x-ray. Consider a consult with an Orthopaedic Surgeon.
Score 30 to 39	May indicate mild to moderate elbow involvement. Consider seeing you family physician for an assessment and possible x-ray. You may benefit from non-surgical treatment, such as exercise, weight loss, and /or anti-inflammatory medication
Score 40 to 48	May indicate satisfactory joint function. May not require any formal treatment.

Reference for Score: Dawson, J., Doll, H., Boller, I., Fitzpatrick, R. The development and validation of a patient-reported questionnaire to assess outcomes of elbow surgery. J Bone Joint Surg Br. 2008 Apr; 90-B: 466 - 473.

MASTER CHART

Group-A

Sl.no	Age (yrs)	Sex	Pretest VAS	Posttest VAS	Pretest Grip Strength	Posttest Grip Strength	Pretest Functional Outcome	Posttest Functional Outcome
1	44	M	6	2	80	110	24	43
2	27	F	7	2	80	110	23	37
3	23	F	5	2	90	110	32	40
4	42	M	5	1	90	130	29	38
5	38	F	6	2	90	120	38	46
6	45	M	7	3	100	130	25	35
7	39	M	6	2	90	140	31	40
8	38	F	6	2	100	140	31	46
9	37	F	7	2	62	126	24	39
10	45	M	7	1	100	142	28	37
11	20	M	6	1	130	160	32	46
12	28	M	4	0	142	186	32	48
13	20	M	6	1	90	150	31	42
14	25	M	5	1	110	140	30	48
15	21	M	6	1	108	156	31	40

Group – B

Sl.no	**Age (**yrs**)**	**Sex**	**Pretest VAS**	**Posttest VAS**	**Pretest Grip Strength**	**Posttest Grip Strength**	**Pretest Functional Outcome**	**Posttest Functional Outcome**
1	23	M	4	0	140	192	34	48
2	21	M	5	0	102	146	28	39
3	25	M	5	0	106	142	30	46
4	29	M	6	2	106	152	26	42
5	24	M	6	1	102	158	22	40
6	29	M	6	2	108	140	31	46
7	27	M	5	1	104	156	24	40
8	23	M	6	2	100	136	30	47
9	22	M	7	1	108	142	31	46
10	24	M	7	1	106	140	30	39
11	22	M	5	0	116	148	26	40
12	19	M	6	2	120	186	28	46
13	24	M	4	0	140	164	29	48
14	20	M	6	0	140	180	33	48
15	23	M	5	0	130	160	29	48